

# NATURAL RESOURCES CONSERVATION SERVICE

## CONSERVATION PRACTICE STANDARD

### NUTRIENT MANAGEMENT

(Acre)

CODE 590

#### DEFINITION

Managing the amount, source, placement, form and timing of the application of nutrients and soil amendments.

#### PURPOSES

To budget and supply nutrients for plant production.

To properly utilize manure or organic by-products as a plant nutrient source.

To minimize agricultural nonpoint source pollution of surface and ground water resources.

To maintain or improve the physical, chemical and biological condition of soil.

#### CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where plant nutrients and soil amendments are applied.

#### CRITERIA

##### General Criteria Applicable to All Purposes.

Plans for nutrient management shall comply with all applicable Federal, state, and local laws and regulations.

Plans for nutrient management shall be developed in accordance with policy requirements of the NRCS General Manual Title 450, Part 401.03 (Technical Guides, Policy and Responsibilities) and Title 190,

Part 402 (Ecological Sciences, Nutrient Management, Policy); technical requirements of the NRCS Field Office Technical Guide (FOTG); procedures contained in the National Planning Procedures Handbook (NPPH), and the NRCS National Agronomy Manual (NAM) Section 503.

Persons who review or approve plans for nutrient management shall be certified through any certification program acceptable to NRCS within the state. Producers will be able to develop their own nutrient management plans. These plans will be approved by an individual certified through a certification program approved by NRCS.

Plans for nutrient management that are elements of a more comprehensive conservation plan shall recognize other requirements of the conservation plan and be compatible with its other requirements.

A nutrient management plan for nitrogen (N), phosphorus (P), and potassium (K) shall be developed that considers all potential sources of nutrients including, but not limited to:

- legume credits,
- animal manure and organic by-products,
- waste water,
- commercial fertilizer,
- crop rotation,
- soil nutrient availability,
- and irrigation water.

Land receiving nutrients shall be evaluated for environmentally sensitive areas such as, but not limited to:

- perennial water bodies,
- areas of concentrated flow,
- surface inlets,
- Karst topography,
- wellhead protection areas,
- flood plain,
- coarse textured soils.

### **Soil Sampling and Laboratory Analysis (Testing).**

At a minimum, obtain soil test analyses for phosphorus, potassium, and pH. All soil samples shall be collected according to Iowa State University (ISU) recommendations. See ISU PM-1428C "Protecting Our Water Quality with Effective Soil Sampling." The minimum frequency for soil testing shall be once during a four-year period for continuous row crop or once during the cycle of other crop rotations that consist of close grown crops such as grasses and legumes. The sampling frequency can be less frequent for organic matter, but every 12 years is recommended.

Use of the Late Spring Nitrate Test and Fall Corn Stalk Test is encouraged in determining rates of nitrogen and/or evaluating the nitrogen management program. See ISU publications PM-1714 "Nitrogen Fertilizer Recommendations for Corn in Iowa" and PM 1584 "Corn Stalk Test to Determine Nitrogen".

All soil tests shall be analyzed by a soil test lab that is certified according to Iowa Department of Agriculture and Land Stewardship (IDALS) soil test lab certification standards. See ISU-Extension publication, PM-1310 (rev) "Interpretation of Soil Test Results."

### **Nutrient Application Rates.**

Nutrient application includes form, source, amount, timing and method of application on each field. Plant nutrients may be applied as broadcast, starter, surface band other than starter, or injected band applications. Nutrients shall be applied to achieve realistic production

goals, while minimizing nitrogen and/or phosphorus movement to surface and/or ground waters.

All nutrient applications shall be based on ISU recommendations for the soil type and crop to be grown unless specified in "Additional Criteria Applicable to Manure or Organic By-Products Applied as a Plant Nutrient Source". Use the most recent publications. See ISU-Extension Publications PM 1714 "Nitrogen Fertilizer Recommendations for Corn in Iowa", PM-1688 "General Guide for Crop Nutrient Recommendations in Iowa", PM 1811 "Managing Manure Nutrients for Crop Production" and PM 869 "Fertilizing Pasture".

All nutrient applications shall be based on realistic yield potential for the field. Guidance for estimating realistic yield potentials is outlined in ISU-Extension Publication PM-1268 (rev) "Establishing Realistic Yields." Realistic yield potentials can be established based on soil productivity information, historical yield data, climatic conditions, level of management and/or local research on similar soils, cropping systems, and soil and manure/organic by-products tests. For new crops or varieties, industry yield recommendations may be used until documented yield information is available.

#### **A. Phosphorus and Potassium.**

1. All nutrient values for phosphorus and potassium should be expressed in pounds of  $P_2O_5$  and  $K_2O$ .
2. Phosphorus and potassium application for crop and forage production (including non-crop areas) shall be based on soil test results. Phosphorus and potassium additions shall not exceed crop removal rates when soil test levels are optimum or above unless specified under "Additional Criteria Applicable to

**Manure or Organic By-Products  
Applied as a Plant Nutrient Source”.**

**B. Commercial Nitrogen:**

The amount of nitrate-nitrogen that moves below the crop root zone is directly related to nitrogen application rate. Therefore, over-application in an attempt to produce unrealistic yields or offset anticipated losses shall be avoided.

1. No fall application of nitrogen shall be made with the following exceptions:

- a. Anhydrous ammonia if:
  - mid-day soil temperatures, at 4”soil depth, is not greater than 50°F and trending lower
  - soil moisture conditions are conducive to proper application and sealing
  - soil texture conditions favor the retention of applied nitrogen (Anhydrous should not be applied to coarse soil types, greater than 2 mm on the USDA Textural Classification System).
- b. Application of Nitrogen associated with P and K containing products.
- c. Nitrogen associated with the production of winter grains.

2. Where the Late Spring Nitrate Test is not applicable, use the general recommendations for nitrogen found in Iowa State Publications ISU PM-1714 “Nitrogen Fertilizer Recommendations for Corn in Iowa”, ISU PM-869 “Fertilizing Pasture”, ISU PM-1584 “Cornstalk Testing to Evaluate Nitrogen Management”.

- C. Legume, manure, and other organic nutrient sources including bulk dry animal nutrients regulated under Iowa Code 200A.

All nutrient additions shall be adjusted for contributions from legumes, manure or other organic nutrient sources.

1. Legume contributions are shown in ISU Publication PM-1714 “Nitrogen Fertilizer Recommendations for Corn in Iowa”.
2. Manure shall be analyzed for nutrient content of nitrogen, phosphorus and potassium. This analysis shall be done each time the storage facility is emptied until a consistent trend is evident. Methods for sampling manure are shown in ISU Publication PM-1558 “How to Sample Manure for Nutrient Analysis”. If it is not practical to analyze the manure, the values shown in ISU Publication PM-1811 “Managing Manure Nutrients for Crop Production” shall be used.
3. When determining allowable nutrient application rates from manure or other organic sources, nitrogen may be applied based on crop nitrogen needs for that crop year. In most cases, this will allow application of more phosphorus and potassium than required by crop needs. Application based on crop nitrogen needs may continue unless otherwise specified under “Additional Criteria Applicable to Manure or Organic By-Products Applied as a Plant Nutrient Source”.
4. For additional information on manure and other organic nutrient management refer to Standard and Specification Waste Utilization (633) and the Agricultural Waste Management Field Handbook.

**D. Soil pH.**

Soil pH shall be maintained at levels shown in ISU Publication PM-1688 “General Guide for Crop Nutrient Recommendations in Iowa”. All

recommendations are based on Effective Calcium Carbonate Equivalents (ECCE).

For soil tests requiring less than 2000 pounds per acre ECCE, the lime requirement may be waived.

#### E. Calibration.

Application equipment for fertilizers and manure shall be calibrated at least annually to determine actual applied rates. After calibration, adjustments can be made in the application process to meet the planned or intended rates.

All specifications will be consistent with federal, state, and local regulations.

#### Nutrient Application Timing.

The timing of nutrient application shall correspond as closely as possible with plant nutrient uptake characteristics, while considering cropping system limitations, weather and climatic conditions, field accessibility, manure storage capacity and application equipment constraints.

#### Nutrient Application Methods.

Commercial nutrients and organic nutrient sources shall not be surface applied to frozen, snow covered ground, or saturated soil if a potential risk for runoff exists. A potential risk for runoff exists on slopes greater than 5% unless erosion is controlled to tolerable levels or less. Manure may be surface applied to frozen, snow covered or saturated ground only under one of the following conditions.

- Where storage capacity is limited or non existent, manure may be applied to frozen, snow covered, or saturated ground when storage facilities are full.
- On an emergency basis.

Manure surface applied to frozen, snow covered, or saturated ground shall be based on a manure disposal plan. That plan shall include:

1. Under what circumstances the manure may be applied to frozen, snow covered, or saturated ground. (Ex: storage capacity exceeded).
2. Rates of application.
3. Area of application.
4. Other requirements such as runoff control as indicated through the use of the Phosphorus Index assessment tool.

#### **Additional Criteria Applicable to Manure or Organic By-Products Applied as a Plant Nutrient Source.**

#### **Nutrient Application Rates.**

The planned rates of nitrogen and phosphorus application recorded in the plan shall be determined based on the following guidance:

##### A. Nitrogen Application.

When determining allowable nutrient application rates from manure or other organic sources, nitrogen may be applied based on crop nitrogen needs for that crop year. In most cases, this will allow application of more phosphorus and potassium than required by the crop. This may continue as long as the risk of phosphorus moving to surface waters based on the Iowa Phosphorus Index is very low or low.

When the plan is being implemented on a phosphorus standard, manure or other organic by-products shall be applied at rates consistent with the phosphorus standard. In such situations, an additional nitrogen application, from nonorganic sources, may be required to supply the recommended amounts of nitrogen.

Manure or other organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in the

harvested portion of the crop that is removed from the field in that growing season.

#### B. Phosphorus Application.

When manure or other organic by-products are used, the planned rates of phosphorus application shall be determined with reference to the Iowa Phosphorus Index (Agronomy Technical Notice 25). The Iowa Phosphorus Index (Iowa PI) assesses the potential for phosphorus movement from a field to surface water, and designates fields as very low risk, low risk, medium risk, high risk, and very high risk. Conservation practices and/or phosphorus management practices can be adopted that reduce the risk of phosphorus movement and may reduce the risk rating on the field. See Agronomy Technical Notice 25, Iowa Phosphorus Index.

If a field is rated very low risk, low risk, or medium risk by the Iowa PI, the application of manure or organic by-products may be made based on the nitrogen needs of the crop as set forth in subpart A above.

If a field is rated in the medium risk category, planned conservation and phosphorus management practices should not increase the rating of the field above the medium risk category.

If a field is rated high risk or very high risk by the Iowa PI;

- a. Manure or organic by-products may be applied to meet the needs of the planned crop rotation for phosphorus removal if conservation practices and/or phosphorus management practices are adopted to reduce the risk of phosphorus movement.
- b. Nitrogen application limits of Subpart A above should not be exceeded.

#### C. Sensitive Areas.

Manure and other organic nutrient sources shall not be applied to the following areas unless injected or incorporated within 24 hours:

1. Within 200 feet of sinkholes, drainage wells, or other direct conduits to the groundwater.
2. Within 200 feet of lakes, ponds, or other perennial water bodies.
3. On land that floods more than once every 10 years, inject or incorporate within 24 hours during the peak flood periods (April, May, June, July).

#### Field Risk Assessment.

When animal manure or other organic by-products are applied, a field-specific assessment of the potential for phosphorus transport from the field shall be completed. This assessment may be done using the Iowa Phosphorus Index assessment tool. The nutrient management plans shall include:

a record of the assessment rating for each field or sub-field, and

information about conservation practices and management activities that can reduce the potential for phosphorus movement from the site.

When such assessments are done, the results of the assessment and recommendations shall be discussed with the producer during the development of the nutrient management plan.

#### Heavy Metals Monitoring.

When sewage sludge is applied, the application of potential heavy metal pollutants (including arsenic, cadmium, copper, lead, mercury, selenium, and zinc) in the soil shall be in accordance with the US Code, Reference 40 CFR, Parts 403 and 503, Iowa Administrative Code (IAC) IA567--67, IAC567--120, and IAC567--121.

**Additional Criteria to Minimize Agricultural Non-point Source Pollution of Surface and Ground Water Resources.**

A. In areas with an identified or designated phosphorus-related water quality impairment, an assessment shall be completed of the potential phosphorus transport from the field. These areas are those waters identified in the Iowa Department of Natural Resources (DNR) Iowa 303 (d) list as impacted by phosphorus. This listing can be found on DNR home page at <http://www.state.ia.us/epd/wtresrce/303dnotc.htm>.

The Iowa Phosphorus Index (PI) shall be used to make these assessments. The results of these assessments and recommendations shall be discussed with the producer and included in the nutrient management plan.

B. In fields with a current soil test phosphorus level in the very high range as shown in ISU Publication PM-1688 "General Guide for Crop Nutrient Recommendation in Iowa" or when soil losses exceed the tolerable levels, an assessment shall be completed of the potential phosphorus transport from the field. See Agronomy Technical Note 25, Iowa Phosphorus Index.

If a field is rated high risk or very high risk by the Iowa PI;

1. Fertilizer may be applied to meet the needs of the planned crop rotation for phosphorus removal if conservation practices and/or phosphorus management practices are adopted to reduce the risk of phosphorus movement.
2. Nitrogen application limits of Subpart A above should not be exceeded.

C. In area where Karst topography or sandy soils poses a risk to ground water resources an assessment of the leaching risk will be made with a Nitrogen Leaching

Index. Under high-risk categories the following criteria will be followed:

- Commercial nitrogen fertilizer for spring seeded crops shall not be fall applied.
- On sandy soils with high permeability (greater than 2 inches per hour), nitrogen shall be applied using split spring preplant, preemergent and/or post applications to provide distribution of nutrients at a time when plants will utilize the nutrients.

**Additional Criteria to Improve the Physical, Chemical, and Biological Condition of the Soil.**

Nutrients shall be applied in such a manner that does not degrade the soil's structure, chemical properties, or biological condition.

Nutrients shall not be applied to flooded or saturated soils when the potential for soil compaction and creation of ruts is high.

**CONSIDERATIONS**

Considerations are items to be considered during the planning process, however, are not a required component of the nutrient management plan.

1. Soil erosion transports sediment attached nutrients to offsite locations. Planning and applying conservation practices to reduce soil erosion will also reduce offsite impacts of these nutrients.
2. Evaluate the effect of nutrient sources on plant growth characteristics such as nutrient content, solubility, leachability, mobility, adsorption, and volatility on plant growth and production and how it affects the nutrient budget. Consider effects of seasonal water budget on nutrient balances of or potential loss from the plant environment.

3. Spring preplant, sidedress, and split applications of nitrogen are recommended for corn production. Use of the Late Spring Nitrate Test and Fall Corn Stalk Test is also encouraged including when corn is grown after forage, legumes and on manured soils.
4. Maintenance of good soil tilth will make plant nutrient absorption more efficient. Good tilth will reduce the need to apply fertilizer in order to overcome poor root development. See Conservation Cropping Sequence Standard (practice code 328).
5. In years of normal fertilizer application and unexpected low yields, excess nutrients can accumulate in the soil. Unused nitrogen can leach and pollute water supplies. Consider the available nitrogen and use the Late Spring Nitrate Test to determine available nitrogen. Establishing a winter cover crop can reduce the amount of nitrogen available for leaching by tying up unused nitrogen and recycling to later crops. Cover crops can reduce soil moisture in the spring causing establishment problems for succeeding crops.
6. It is important to keep pH in the proper range. To some degree, soil pH has an effect on the availability of almost all of the essential elements.
7. Assess the site characteristics such as soil, geology, depth to water table, proximity to surface water, topography, climate, odor considerations with regards to proximity to other rural residents, and sensitive environmental elements.
8. Assess the effect that nutrient applications have on site characteristics through the use of leaching indices or other tools.
9. As soil tests for phosphorus and potassium increase from "very low" to "very high", the probability of an economic response to additional fertilizer decreases. There is a high probability that there will be a large economic response to the addition of fertilizer to a field testing "very low". Nutrient additions to fields testing "high" to "very high" in phosphorus or potassium may be postponed without short-term effects on crop production.
10. In determining nitrogen availability for crop consideration should be given to application methods and losses.
11. Because of potential economic and environmental loss consider the risk of fall application of anhydrous ammonia.
12. As new technology is developed consider feed management activities that may reduce the nutrient content of manure. Feed management may include phase feeding, amino acid supplemented low crude protein diets, use of low phytin phosphorus grain and enzymes such as phytase.

## PLANS AND SPECIFICATIONS

Plans and specifications shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s), using nutrients to achieve production goals and to prevent or minimize water quality impairment.

The following components shall be included in the nutrient management plan:

- aerial photograph or map and a soil map of the site,
- current and/or planned plant production sequence or crop rotation,
- results of soil, plant, water, manure or organic by-product sample analyses,
- realistic yield potential for the crops in the rotation,
- quantification of all nutrient sources,
- recommended nutrient rates, timing, form, and method of application and incorporation,

- location of designated sensitive areas or resources and the associated nutrient management restriction,
- guidance for implementation, operation, maintenance, recordkeeping, and
- complete field by field nutrient budget for nitrogen, phosphorus, and potassium for the rotation or crop sequence.
- a statement that the plan was developed based on the requirements of the current standard and any applicable Federal, state, or local regulations or policies; and that changes in any of these requirements may necessitate a revision of the plan.

In addition to the requirements described above, plans for nutrient management shall also include:

- discussion about the relationship between nitrogen and phosphorus transport and water quality impairments. This should include information about nitrogen leaching into shallow ground water and potential health impacts. Information on phosphorus should include warnings on phosphorus accumulation in the soil, the increased potential for phosphorus transport in soluble form, and the types of water quality impairment that could result from phosphorus movement into surface water bodies.
- identify the size of the land base needed to enable plan implementation based on phosphorus, even when initial implementation will be based on nitrogen, unless other provisions that do not involve land application are made for utilizing the manure.
- discussion about how the plan is intended to prevent the nutrients (nitrogen and phosphorus) supplied for production purposes from contributing to water quality impairments.

## OPERATION AND MAINTENANCE

The owner/client is responsible for safe operation and maintenance of this practice including all equipment. Operation and maintenance addresses the following:

- periodic plan review to determine if adjustments or modifications to the plan are needed. As a minimum, plans will be reviewed and revised with each soil test cycle.
- protection of fertilizer and organic by-product storage facilities from weather and accidental leakage or spillage.
- calibration of application equipment to provide for even application of fertilizer and manure at intended rates.
- documentation of the actual rate at which nutrients were applied. When the actual rates used differ from or exceed the recommended and planned rates, records will indicate the reasons for the differences.
- Maintaining records to document plan implementation. As applicable, records include:
  - soil test results and recommendations for nutrient application,
  - quantities, analyses and sources of nutrients applied,
  - dates and methods of nutrient applications,
  - crops planted, planting and harvest dates, yields, and crop residues removed,
  - results of water, plant, and organic by-product analyses, and
  - dates of review and person performing the review, and recommendations that resulted from the review.

Records should be maintained for five years; or longer than five years if

required by other Federal, state, or local ordinances, or program or contract requirements.

Workers should be protected from and avoid unnecessary contact with chemical fertilizers and organic by-products. Protection should include the use of protective clothing when working with plant nutrients. Extra caution must be taken when handling ammonia sources of nutrients, or when dealing with organic wastes stored in unventilated enclosures.

The disposal of material generated by cleaning nutrient application equipment should be accomplished properly. Excess material should be collected and stored or field applied in an appropriate manner. Excess material should not be applied on areas of high potential risk for runoff and leaching.

at

<http://www.extension.iastate.edu/Pages/pubs/>.

- ISU PM-1428C "Protecting Our Water Quality with Effective Soil Sampling"
- ISU PM-1310 "Interpretation of Soil Test Results"
- ISU PM-1714 "Nitrogen Fertilizer Recommendations for Corn in Iowa"
- ISU PM-1688 "General Guide for Crop Nutrient Recommendations in Iowa"
- ISU PM-869 "Fertilizing Pasture"
- ISUPM-1268(rev) "Establishing Realistic Yields"
- ISU PM-1584 "Cornstalk Testing to Evaluate Nitrogen Management"
- ISU PM-1436 "Nitrogen Fertilizer Management for Northeast Iowa"
- ISU PM-569 "Warm-Season Grasses for hay and Pasture"
- ISU PM-1811 "Managing Manure Nutrients for Crop Production"
- ISU PM-1558 "How to Sample Manure for Nutrient Analysis"

The following publication is available on the NRCS Fort Worth Home page at <http://www.ftw.nrcs.usda.gov/awmfh.html>

- Agricultural Waste Management Field Handbook

The following publications are available at the Iowa Conservation Partners Home page at: <http://www.ia.nrcs.usda.gov>.

- Iowa Technical Note 25, Iowa Phosphorus Index
- Background and Basic Concepts of the Phosphorus Index
- Phosphorus Index Calculator (Excel Spreadsheet)
- Waste Utilization Standard (633)

## REFERENCES

These publications are available at County Extension Offices; Extension Distribution Center, Printing Building, Iowa State University, Ames, IA 50011; and several are available on the ISU Publications Home page